SEQUENCE LISTING

<110> Evologic S.A.

Maliere Technologies Société Civile

Rhodia Chimie

Marliere, Phillipe

<120> Cloning of gluconate dehydratase gcnD gene

<130> G 3111 EP

<160> 33

<170> PatentIn version 3.1

<210> 1

<211> 1812

<212> DNA

<213> Agrobacterium tumefaciens

<220>

<221> CDS

<222> (1)..(1809)

<223>

<400> 1

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atg acg aca tct gat aat ctt cct gca act cag ggc aag ctc cgt tcg       48
Met Thr Thr Ser Asp Asn Leu Pro Ala Thr Gln Gly Lys Leu Arg Ser
1               5                   10                  15

cgc gcc tgg ttc gac aac cca gcc aat gcg gac atg acc gcg ctt tat       96
Arg Ala Trp Phe Asp Asn Pro Ala Asn Ala Asp Met Thr Ala Leu Tyr
            20                  25                  30

ctc gag cgt tac atg aac ttc ggt ctc agc cag gcc gag ctt cag tcc      144
Leu Glu Arg Tyr Met Asn Phe Gly Leu Ser Gln Ala Glu Leu Gln Ser
        35                  40                  45
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gac cgc ccg att atc ggt att gcg cag acc ggt tcc gac ctt tcg ccc      192
Asp Arg Pro Ile Ile Gly Ile Ala Gln Thr Gly Ser Asp Leu Ser Pro
    50                  55                  60

tgc aac cgt cat cat ctg gaa ctc gcc aac cgt ctg cgt gaa ggc att      240
Cys Asn Arg His His Leu Glu Leu Ala Asn Arg Leu Arg Glu Gly Ile
65                  70                  75                  80

cgt gaa gcc ggc ggc atc gcc atc gaa ttc ccg gtg cat ccg atc cag      288
Arg Glu Ala Gly Gly Ile Ala Ile Glu Phe Pro Val His Pro Ile Gln
                85                  90                  95

gaa acc ggt aag cgt ccg aca gcg ggc ctt gat cgc aac ctg gct tac      336
Glu Thr Gly Lys Arg Pro Thr Ala Gly Leu Asp Arg Asn Leu Ala Tyr
            100                 105                 110

ctc ggc ctc gtg gaa gtg ctt tat ggc tat ccg ctc gac ggc gtt gtt      384
Leu Gly Leu Val Glu Val Leu Tyr Gly Tyr Pro Leu Asp Gly Val Val
        115                 120                 125

ctg acc atc ggc tgc gac aag acc acg cct gcc tgt ctt atg gcg gcg      432
Leu Thr Ile Gly Cys Asp Lys Thr Thr Pro Ala Cys Leu Met Ala Ala
    130                 135                 140

gcc acc gtc aac att ccg gcc atc gcc ctt tcc gtc ggt ccc atg ctg      480
Ala Thr Val Asn Ile Pro Ala Ile Ala Leu Ser Val Gly Pro Met Leu
145                 150                 155                 160

aac ggc tgg ttc cgc ggt gag cgc acc ggt tcc ggc acc atc gtc tgg      528
Asn Gly Trp Phe Arg Gly Glu Arg Thr Gly Ser Gly Thr Ile Val Trp
                165                 170                 175

aag gcc cgc gaa ctg ctg gcg aag ggc gag atc gat tac cag ggc ttc      576
Lys Ala Arg Glu Leu Leu Ala Lys Gly Glu Ile Asp Tyr Gln Gly Phe
            180                 185                 190

gtc aag ctc gtt gcc tcg tct gcc ccg tcc acc ggc tat tgc aac acc      624
Val Lys Leu Val Ala Ser Ser Ala Pro Ser Thr Gly Tyr Cys Asn Thr
        195                 200                 205

atg ggc acg gca aca acc atg aac tcg ctc gcc gaa gcg ctc ggc atg      672
Met Gly Thr Ala Thr Thr Met Asn Ser Leu Ala Glu Ala Leu Gly Met
    210                 215                 220

cag ctt ccc ggc tcc gcc gcc att ccg gcg cct tac cgt gac cgt cag      720
Gln Leu Pro Gly Ser Ala Ala Ile Pro Ala Pro Tyr Arg Asp Arg Gln
225                 230                 235                 240

gaa gtc tct tac ctc acc ggc ctg cgc atc gtc gac atg gtc agg gaa      768
Glu Val Ser Tyr Leu Thr Gly Leu Arg Ile Val Asp Met Val Arg Glu
                245                 250                 255

gac ctg aaa cca tca gac atc atg acc aag gat gcc ttc atc aac gcc      816
Asp Leu Lys Pro Ser Asp Ile Met Thr Lys Asp Ala Phe Ile Asn Ala
            260                 265                 270

atc cgc gtt aat tcg gcg atc ggc ggt tcc acc aac gcg ccg atc cat      864
Ile Arg Val Asn Ser Ala Ile Gly Gly Ser Thr Asn Ala Pro Ile His
        275                 280                 285
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cta aac ggc ctt gcc cgc cat gtc ggc gtc gag ctg acg gtg gat gac      912
Leu Asn Gly Leu Ala Arg His Val Gly Val Glu Leu Thr Val Asp Asp
    290                 295                 300

tgg cag acc tat ggc gaa gac gtg ccg ctg ctc gtc aac ctg cag ccg      960
Trp Gln Thr Tyr Gly Glu Asp Val Pro Leu Leu Val Asn Leu Gln Pro
305                 310                 315                 320

gca ggc gaa tat ctc ggc gag gac tat tac cat gcc ggc ggc gtt ccc     1008
Ala Gly Glu Tyr Leu Gly Glu Asp Tyr Tyr His Ala Gly Gly Val Pro
                325                 330                 335

gct gtc gtc aat cag ctg atg acc caa ggg ctg atc atg gaa gac gcc     1056
Ala Val Val Asn Gln Leu Met Thr Gln Gly Leu Ile Met Glu Asp Ala
            340                 345                 350

atg acc gtc aac ggc aag acc atc ggc gac aat tgc cgt ggc gcg atc     1104
Met Thr Val Asn Gly Lys Thr Ile Gly Asp Asn Cys Arg Gly Ala Ile
        355                 360                 365

atc gaa gac gag aag gtc atc cgc ccc tat gag cag ccg ctc aag gag     1152
Ile Glu Asp Glu Lys Val Ile Arg Pro Tyr Glu Gln Pro Leu Lys Glu
    370                 375                 380

cgt gcc ggc ttc cgc gtt ctg cgc ggc aat ctg ttc tcc tcg gcc atc     1200
Arg Ala Gly Phe Arg Val Leu Arg Gly Asn Leu Phe Ser Ser Ala Ile
385                 390                 395                 400

atg aag aca agc gtg att tcg gaa gaa ttc cgc ggt cgt tac ctc tcc     1248
Met Lys Thr Ser Val Ile Ser Glu Glu Phe Arg Gly Arg Tyr Leu Ser
                405                 410                 415

aac cct gat gat ccg gaa gcc ttc gaa ggc cgc gcc gtg gtg ttc gat     1296
Asn Pro Asp Asp Pro Glu Ala Phe Glu Gly Arg Ala Val Val Phe Asp
            420                 425                 430

ggt ccg gag gat tac cat cat cgc atc gac gat ccg tcg ctt ggc atc     1344
Gly Pro Glu Asp Tyr His His Arg Ile Asp Asp Pro Ser Leu Gly Ile
        435                 440                 445

gac gcc aac acc gtc ctg ttc atg cgc ggc gcc ggt ccg atc ggt tac     1392
Asp Ala Asn Thr Val Leu Phe Met Arg Gly Ala Gly Pro Ile Gly Tyr
    450                 455                 460

ccg ggc gca gcg gaa gtg gtg aac atg cgc gcg ccg gat tac ctt ctg     1440
Pro Gly Ala Ala Glu Val Val Asn Met Arg Ala Pro Asp Tyr Leu Leu
465                 470                 475                 480

aag caa ggc gtc agt tcg ctg ccc tgc atc ggc gat ggc cgc cag tcc     1488
Lys Gln Gly Val Ser Ser Leu Pro Cys Ile Gly Asp Gly Arg Gln Ser
                485                 490                 495

ggc acg tcg ggc agc cca tcc atc ctc aat gcc tcg ccg gaa gcg gcg     1536
Gly Thr Ser Gly Ser Pro Ser Ile Leu Asn Ala Ser Pro Glu Ala Ala
            500                 505                 510

gcc ggc ggc ggt ctg tct att ctg cag acg ggt gac cgc gtc cgc atc     1584
Ala Gly Gly Gly Leu Ser Ile Leu Gln Thr Gly Asp Arg Val Arg Ile
        515                 520                 525
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gat gtg ggc cgc ggc aag gcc gat atc ctg ata tca ggt gaa gag ctc     1632
Asp Val Gly Arg Gly Lys Ala Asp Ile Leu Ile Ser Gly Glu Glu Leu
   530                 535                 540

gcc aag cgt tac gag gcg ctg gca gct cag ggc ggt tat aag ttc ccc     1680
Ala Lys Arg Tyr Glu Ala Leu Ala Ala Gln Gly Gly Tyr Lys Phe Pro
545                 550                 555                 560

gac cac cag acg ccg tgg cag gaa atc cag cgc ggt atc gtc agc cag     1728
Asp His Gln Thr Pro Trp Gln Glu Ile Gln Arg Gly Ile Val Ser Gln
                565                 570                 575

atg gaa acc ggc gcg gtt ctg gaa ccg gcc gta aag tat cag cgc atc     1776
Met Glu Thr Gly Ala Val Leu Glu Pro Ala Val Lys Tyr Gln Arg Ile
            580                 585                 590

gcc cag acc aag ggc ctg ccg cgc gat aac cac tga                    1812
Ala Gln Thr Lys Gly Leu Pro Arg Asp Asn His
        595                 600
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<210> 2

<211> 603

<212> PRT

<213> Agrobacterium tumefaciens

<400> 2

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Arg Ala Trp Phe Asp Asn Pro Ala Asn Ala Asp Met Thr Ala Leu Tyr
            20                  25                  30

Leu Glu Arg Tyr Met Asn Phe Gly Leu Ser Gln Ala Glu Leu Gln Ser
        35                  40                  45

Asp Arg Pro Ile Ile Gly Ile Ala Gln Thr Gly Ser Asp Leu Ser Pro
    50                  55                  60

Cys Asn Arg His His Leu Glu Leu Ala Asn Arg Leu Arg Glu Gly Ile
65                  70                  75                  80

Arg Glu Ala Gly Gly Ile Ala Ile Glu Phe Pro Val His Pro Ile Gln
                85                  90                  95

Glu Thr Gly Lys Arg Pro Thr Ala Gly Leu Asp Arg Asn Leu Ala Tyr
            100                 105                 110
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Leu Gly Leu Val Glu Val Leu Tyr Gly Tyr Pro Leu Asp Gly Val Val
        115                 120                 125

Leu Thr Ile Gly Cys Asp Lys Thr Thr Pro Ala Cys Leu Met Ala Ala
    130                 135                 140

Ala Thr Val Asn Ile Pro Ala Ile Ala Leu Ser Val Gly Pro Met Leu
145                 150                 155                 160

Asn Gly Trp Phe Arg Gly Glu Arg Thr Gly Ser Gly Thr Ile Val Trp
                165                 170                 175

Lys Ala Arg Glu Leu Leu Ala Lys Gly Glu Ile Asp Tyr Gln Gly Phe
            180                 185                 190

Val Lys Leu Val Ala Ser Ser Ala Pro Ser Thr Gly Tyr Cys Asn Thr
        195                 200                 205

Met Gly Thr Ala Thr Thr Met Asn Ser Leu Ala Glu Ala Leu Gly Met
    210                 215                 220

Gln Leu Pro Gly Ser Ala Ala Ile Pro Ala Pro Tyr Arg Asp Arg Gln
225                 230                 235                 240

Glu Val Ser Tyr Leu Thr Gly Leu Arg Ile Val Asp Met Val Arg Glu
                245                 250                 255

Asp Leu Lys Pro Ser Asp Ile Met Thr Lys Asp Ala Phe Ile Asn Ala
            260                 265                 270

Ile Arg Val Asn Ser Ala Ile Gly Gly Ser Thr Asn Ala Pro Ile His
        275                 280                 285

Leu Asn Gly Leu Ala Arg His Val Gly Val Glu Leu Thr Val Asp Asp
    290                 295                 300

Trp Gln Thr Tyr Gly Glu Asp Val Pro Leu Leu Val Asn Leu Gln Pro
305                 310                 315                 320

Ala Gly Glu Tyr Leu Gly Glu Asp Tyr Tyr His Ala Gly Gly Val Pro
                325                 330                 335

Ala Val Val Asn Gln Leu Met Thr Gln Gly Leu Ile Met Glu Asp Ala
            340                 345                 350
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Met Thr Val Asn Gly Lys Thr Ile Gly Asp Asn Cys Arg Gly Ala Ile
        355                 360                 365

Ile Glu Asp Glu Lys Val Ile Arg Pro Tyr Glu Gln Pro Leu Lys Glu
    370                 375                 380

Arg Ala Gly Phe Arg Val Leu Arg Gly Asn Leu Phe Ser Ser Ala Ile
385                 390                 395                 400

Met Lys Thr Ser Val Ile Ser Glu Glu Phe Arg Gly Arg Tyr Leu Ser
                405                 410                 415

Asn Pro Asp Asp Pro Glu Ala Phe Glu Gly Arg Ala Val Val Phe Asp
            420                 425                 430

Gly Pro Glu Asp Tyr His His Arg Ile Asp Asp Pro Ser Leu Gly Ile
        435                 440                 445

Asp Ala Asn Thr Val Leu Phe Met Arg Gly Ala Gly Pro Ile Gly Tyr
    450                 455                 460

Pro Gly Ala Ala Glu Val Val Asn Met Arg Ala Pro Asp Tyr Leu Leu
465                 470                 475                 480

Lys Gln Gly Val Ser Ser Leu Pro Cys Ile Gly Asp Gly Arg Gln Ser
                485                 490                 495

Gly Thr Ser Gly Ser Pro Ser Ile Leu Asn Ala Ser Pro Glu Ala Ala
            500                 505                 510

Ala Gly Gly Gly Leu Ser Ile Leu Gln Thr Gly Asp Arg Val Arg Ile
        515                 520                 525

Asp Val Gly Arg Gly Lys Ala Asp Ile Leu Ile Ser Gly Glu Glu Leu
    530                 535                 540

Ala Lys Arg Tyr Glu Ala Leu Ala Ala Gln Gly Gly Tyr Lys Phe Pro
545                 550                 555                 560

Asp His Gln Thr Pro Trp Gln Glu Ile Gln Arg Gly Ile Val Ser Gln
                565                 570                 575

Met Glu Thr Gly Ala Val Leu Glu Pro Ala Val Lys Tyr Gln Arg Ile
            580                 585                 590
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Ala Gln Thr Lys Gly Leu Pro Arg Asp Asn His
        595                 600
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<210> 3

<211> 1272

<212> DNA

<213> Agrobacterium tumefaciens

<220>

<221> CDS

<222> (1)..(1269)

<223>

<400> 3

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Met Gln Ser Ser Ser Ala Leu Arg Gln Ser Thr Gly Asp Gln Ser Glu
1               5                   10                  15

tac cat gcc cag tcg aat atg atc ggc tct agc ccg gcg gac ggt ttg       96
Tyr His Ala Gln Ser Asn Met Ile Gly Ser Ser Pro Ala Asp Gly Leu
            20                  25                  30

ctc gca ttg ccg ctt ctg acc gtc gat ctt gcc gtc tat cgc ggt aat      144
Leu Ala Leu Pro Leu Leu Thr Val Asp Leu Ala Val Tyr Arg Gly Asn
        35                  40                  45

cgg gat cgc ttt ctt gcg ctt gtc tcg gcc cat gga gcg aag gcg gct      192
Arg Asp Arg Phe Leu Ala Leu Val Ser Ala His Gly Ala Lys Ala Ala
    50                  55                  60

cca cat gcc aag acg ccg atg tgc ccg gag atc gcg atc gat ctg att      240
Pro His Ala Lys Thr Pro Met Cys Pro Glu Ile Ala Ile Asp Leu Ile
65                  70                  75                  80

gaa gcc ggt gcc tgg ggc gcg acg gtc gcc gat ctc ttc cag gcg gaa      288
Glu Ala Gly Ala Trp Gly Ala Thr Val Ala Asp Leu Phe Gln Ala Glu
                85                  90                  95

gtc ctg ctc aag gcc ggc gtg tcg aac ata ttg atc gcc aac cag atc      336
Val Leu Leu Lys Ala Gly Val Ser Asn Ile Leu Ile Ala Asn Gln Ile
            100                 105                 110

ggc gga ttg aca tcc gcc aga cgc cta cgc atg ctc gca gat gct ttt      384
Gly Gly Leu Thr Ser Ala Arg Arg Leu Arg Met Leu Ala Asp Ala Phe
        115                 120                 125

ccg aaa gcc gag att atc tgc tgt gtc gat tct gtt cag gcc tcg gcc      432
Pro Lys Ala Glu Ile Ile Cys Cys Val Asp Ser Val Gln Ala Ser Ala
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    130                 135                 140

aat ctg gtt cag gcc ttt caa ggg cgt gtg gat gcc cca ttc aag gtc      480
Asn Leu Val Gln Ala Phe Gln Gly Arg Val Asp Ala Pro Phe Lys Val
145                 150                 155                 160

ttc atc gaa gtc ggt gtc ggc cgc act ggc gcc cgt acg ttg aat gtt      528
Phe Ile Glu Val Gly Val Gly Arg Thr Gly Ala Arg Thr Leu Asn Val
                165                 170                 175

gca aag gat atc atc gac acc atc tcg aca agt gca gaa atc gta ctg      576
Ala Lys Asp Ile Ile Asp Thr Ile Ser Thr Ser Ala Glu Ile Val Leu
            180                 185                 190

gcc ggt gtg tcg acc tat gaa ggc tcc gtc tcc ggg gaa acg tcg gaa      624
Ala Gly Val Ser Thr Tyr Glu Gly Ser Val Ser Gly Glu Thr Ser Glu
        195                 200                 205

gca ctc gat gca aac atg gcg gcc ctg ttc gat ctc ctg acc gac agt      672
Ala Leu Asp Ala Asn Met Ala Ala Leu Phe Asp Leu Leu Thr Asp Ser
    210                 215                 220

ctt gca tcg ata cgc gaa aaa gat ccc ggg cgc ccg cta acg gtt tca      720
Leu Ala Ser Ile Arg Glu Lys Asp Pro Gly Arg Pro Leu Thr Val Ser
225                 230                 235                 240

gcc ggc ggt tcg atc cat ttc gac cgc gtg ctc gcg gcg ctt gtg ccc      768
Ala Gly Gly Ser Ile His Phe Asp Arg Val Leu Ala Ala Leu Val Pro
                245                 250                 255

gtt tgc gag gcg gat ggc aat gcg acg ttg ttg ctg cgc agc ggc gcc      816
Val Cys Glu Ala Asp Gly Asn Ala Thr Leu Leu Leu Arg Ser Gly Ala
            260                 265                 270

atc ttc ttc tct gat cac ggt gta tat cag cgc ggt ttc cag gca gtc      864
Ile Phe Phe Ser Asp His Gly Val Tyr Gln Arg Gly Phe Gln Ala Val
        275                 280                 285

gac gcc cgc aac cta ctc gca tcc ggc aag gtt gtc ttc aag gca tcc      912
Asp Ala Arg Asn Leu Leu Ala Ser Gly Lys Val Val Phe Lys Ala Ser
    290                 295                 300

gag gca ttt cag ccc tca atg cga atc tgg gcg gag gtc atc tcc gtt      960
Glu Ala Phe Gln Pro Ser Met Arg Ile Trp Ala Glu Val Ile Ser Val
305                 310                 315                 320

cct gag ccg ggg ctg gcg atc gtc ggc atg ggc atg cgg gat gta tcg     1008
Pro Glu Pro Gly Leu Ala Ile Val Gly Met Gly Met Arg Asp Val Ser
                325                 330                 335

ttc gat cag gac ctg ccc gtg gcg ctt cgg ctc cat agg gac gga cat     1056
Phe Asp Gln Asp Leu Pro Val Ala Leu Arg Leu His Arg Asp Gly His
            340                 345                 350

ctg gtc gaa gct gat ctc tct tca tcc gcg aag gtc ggc aag ctc aat     1104
Leu Val Glu Ala Asp Leu Ser Ser Ser Ala Lys Val Gly Lys Leu Asn
        355                 360                 365

gac cag cat gcc ttc ttg tcc ttc ggg aac ggc agc agt ctg gca atc     1152
Asp Gln His Ala Phe Leu Ser Phe Gly Asn Gly Ser Ser Leu Ala Ile
```

```
    370                 375                 380

ggc gat gtc ata gaa ttc ggc atc tcg cat ccc tgc acg tgc ttc gat     1200
Gly Asp Val Ile Glu Phe Gly Ile Ser His Pro Cys Thr Cys Phe Asp
385                 390                 395                 400

cgc tgg cgc gtc ttt cac gga atc gat gga tca ggc cgg atc cag cgc     1248
Arg Trp Arg Val Phe His Gly Ile Asp Gly Ser Gly Arg Ile Gln Arg
                405                 410                 415

atc tac aca acc ttc ttt cac tag                                    1272
Ile Tyr Thr Thr Phe Phe His
            420
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<210> 4

<211> 423

<212> PRT

<213> Agrobacterium tumefaciens

<400> 4

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Tyr His Ala Gln Ser Asn Met Ile Gly Ser Ser Pro Ala Asp Gly Leu
            20                  25                  30

Leu Ala Leu Pro Leu Leu Thr Val Asp Leu Ala Val Tyr Arg Gly Asn
        35                  40                  45

Arg Asp Arg Phe Leu Ala Leu Val Ser Ala His Gly Ala Lys Ala Ala
    50                  55                  60

Pro His Ala Lys Thr Pro Met Cys Pro Glu Ile Ala Ile Asp Leu Ile
65                  70                  75                  80

Glu Ala Gly Ala Trp Gly Ala Thr Val Ala Asp Leu Phe Gln Ala Glu
                85                  90                  95

Val Leu Leu Lys Ala Gly Val Ser Asn Ile Leu Ile Ala Asn Gln Ile
            100                 105                 110

Gly Gly Leu Thr Ser Ala Arg Arg Leu Arg Met Leu Ala Asp Ala Phe
        115                 120                 125

Pro Lys Ala Glu Ile Ile Cys Cys Val Asp Ser Val Gln Ala Ser Ala
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```
    130                 135                 140

Asn Leu Val Gln Ala Phe Gln Gly Arg Val Asp Ala Pro Phe Lys Val
145                 150                 155                 160

Phe Ile Glu Val Gly Val Gly Arg Thr Gly Ala Arg Thr Leu Asn Val
                165                 170                 175

Ala Lys Asp Ile Ile Asp Thr Ile Ser Thr Ser Ala Glu Ile Val Leu
            180                 185                 190

Ala Gly Val Ser Thr Tyr Glu Gly Ser Val Ser Gly Glu Thr Ser Glu
        195                 200                 205

Ala Leu Asp Ala Asn Met Ala Ala Leu Phe Asp Leu Leu Thr Asp Ser
    210                 215                 220

Leu Ala Ser Ile Arg Glu Lys Asp Pro Gly Arg Pro Leu Thr Val Ser
225                 230                 235                 240

Ala Gly Gly Ser Ile His Phe Asp Arg Val Leu Ala Ala Leu Val Pro
                245                 250                 255

Val Cys Glu Ala Asp Gly Asn Ala Thr Leu Leu Leu Arg Ser Gly Ala
            260                 265                 270

Ile Phe Phe Ser Asp His Gly Val Tyr Gln Arg Gly Phe Gln Ala Val
        275                 280                 285

Asp Ala Arg Asn Leu Leu Ala Ser Gly Lys Val Val Phe Lys Ala Ser
    290                 295                 300

Glu Ala Phe Gln Pro Ser Met Arg Ile Trp Ala Glu Val Ile Ser Val
305                 310                 315                 320

Pro Glu Pro Gly Leu Ala Ile Val Gly Met Gly Met Arg Asp Val Ser
                325                 330                 335

Phe Asp Gln Asp Leu Pro Val Ala Leu Arg Leu His Arg Asp Gly His
            340                 345                 350

Leu Val Glu Ala Asp Leu Ser Ser Ser Ala Lys Val Gly Lys Leu Asn
        355                 360                 365

Asp Gln His Ala Phe Leu Ser Phe Gly Asn Gly Ser Ser Leu Ala Ile
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370 375 380

Gly Asp Val Ile Glu Phe Gly Ile Ser His Pro Cys Thr Cys Phe Asp
385 390 395 400

Arg Trp Arg Val Phe His Gly Ile Asp Gly Ser Gly Arg Ile Gln Arg
405 410 415

Ile Tyr Thr Thr Phe Phe His
420

<210> 5

<211> 32

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<213> artificial sequence

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<400> 5
cccttaatta atgacgacat ctgataatct tc 32

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<212> DNA

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<220>

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<211> 32

<212> DNA

<213> artificial sequence

<220>

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<400> 8
cccttaatta atgcagtctt cttcagctct tc 32

<210> 9

<211> 35

<212> DNA

<213> artificial sequence

<220>

<223> oligonucleotide primer

<400> 9
tttgcggccg cctagtgaaa gaaggttgtg tagat 35

<210> 10

<211> 34

<212> DNA

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<220>

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<400> 10
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<210> 11

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<212> DNA

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<220>

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<400> 11
tatagatctc tagtgaaaga aggttgtgta gat 33

<210> 12

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<212> DNA

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<400> 12
gcgttaatta atgagttata ctgtcggtac c 31

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<400> 13
tatgcggccg cttagaggag cttgttaaca gg 32

<210> 14

<211> 2665

<212> DNA

<213> vector

<400> 14

gacgaaaggg cctcgtgata cgcctatttt ataggttaa tgtcatgata ataatggttt 60

cttagacgtc aggtggcact tttcggggaa atgtgcgcgg aacccctatt tgtttatttt 120

tctaaataca ttcaaatatg tatccgctca tgagacaata accctgataa atgcttcaat 180

aatattgaaa aaggaagagt atgagtattc aacatttccg tgtcgccctt attccctttt 240

ttgcggcatt ttgccttcct gtttttgctc acccagaaac gctggtgaaa gtaaaagatg 300

ctgaagatca gttgggtgca cgagtgggtt acatcgaact ggatctcaac agcggtaaga 360

tccttgagag ttttcgcccc gaagaacgtt ttccaatgat gagcactttt aaagttctgc 420

tatgtggcgc ggtattatcc cgtattgacg ccgggcaaga gcaactcggt cgccgcatac 480

actattctca gaatgacttg gttgagtact caccagtcac agaaaagcat cttacggatg 540

gcatgacagt aagagaatta tgcagtgctg ccataaccat gagtgataac actgcggcca 600

acttacttct gacaacgatc ggaggaccga aggagctaac cgcttttttg cacaacatgg 660

gggatcatgt aactcgcctt gatcgttggg aaccggagct gaatgaagcc ataccaaacg 720

acgagcgtga caccacgatg cctgtagcaa tggcaacaac gttgcgcaaa ctattaactg 780

gcgaactact tactctagct tcccggcaac aattaataga ctggatggag gcggataaag 840

ttgcaggacc acttctgcgc tcggcccttc cggctggctg gtttattgct gataaatctg 900

gagccggtga gcgtgggtct cgcggtatca ttgcagcact ggggccagat ggtaagccct 960

cccgtatcgt agttatctac acgacgggga gtcaggcaac tatggatgaa cgaaatagac 1020

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catatatact ttagattgat ttaaaacttc atttttaatt taaaaggatc taggtgaaga 1140

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gctgcttgca aacaaaaaaa ccaccgctac cagcggtggt ttgtttgccg gatcaagagc 1320

taccaactct ttttccgaag gtaactggct tcagcagagc gcagatacca aatactgtcc 1380

ttctagtgta gccgtagtta ggccaccact tcaagaactc tgtagcaccg cctacatacc 1440

tcgctctgct aatcctgtta ccagtggctg ctgccagtgg cgataagtcg tgtcttaccg 1500

ggttggactc aagacgatag ttaccggata aggcgcagcg gtcgggctga acgggggttt 1560

cgtgcacaca gcccagcttg gagcgaacga cctacaccga actgagatac ctacagcgtg 1620

agctatgaga aagcgccacg cttcccgaag ggagaaaggc ggacaggtat ccggtaagcg 1680

gcagggtcgg aacaggagag cgcacgaggg agcttccagg gggaaacgcc tggtatcttt 1740

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gggggcggag cctatggaaa aacgccagca acgcggcctt tttacggttc ctggcctttt 1860

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actcctgttg atagatccag taatgacctc agaactccat ctggatttgt tcagaacgct 240

cggttgccgc cgggcgtttt ttattggtga gaatccaagc tagcttggcg agattttcag 300

gagctaagga agctaaaatg gagaaaaaaa tcactggata taccaccgtt gatatatccc 360

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<213> Zymomonas mobilis

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Gly Leu Lys His His Phe Ala Val Ala Gly Asp Tyr Asn Leu Val Leu
20 25 30

ctt gac aac ctg ctt ttg aac aaa aac atg gag cag gtt tat tgc tgt 144
Leu Asp Asn Leu Leu Leu Asn Lys Asn Met Glu Gln Val Tyr Cys Cys
35 40 45

aac gaa ctg aac tgc ggt ttc agt gca gaa ggt tat gct cgt gcc aaa 192
Asn Glu Leu Asn Cys Gly Phe Ser Ala Glu Gly Tyr Ala Arg Ala Lys
50 55 60

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ggc gca gca gca gcc gtc gtt acc tac agc gtc ggt gcg ctt tcc gca      240
Gly Ala Ala Ala Ala Val Val Thr Tyr Ser Val Gly Ala Leu Ser Ala
65                  70                  75                  80

ttt gat gct atc ggt ggc gcc tat gca gaa aac ctt ccg gtt atc ctg      288
Phe Asp Ala Ile Gly Gly Ala Tyr Ala Glu Asn Leu Pro Val Ile Leu
                85                  90                  95

atc tcc ggt gct ccg aac aac aat gat cac gct gct ggt cac gtg ttg      336
Ile Ser Gly Ala Pro Asn Asn Asn Asp His Ala Ala Gly His Val Leu
            100                 105                 110

cat cac gct ctt ggc aaa acc gac tat cac tat cag ttg gaa atg gcc      384
His His Ala Leu Gly Lys Thr Asp Tyr His Tyr Gln Leu Glu Met Ala
        115                 120                 125

aag aac atc acg gcc gcc gct gaa gcg att tac acc ccg gaa gaa gct      432
Lys Asn Ile Thr Ala Ala Ala Glu Ala Ile Tyr Thr Pro Glu Glu Ala
    130                 135                 140

ccg gct aaa atc gat cac gtg att aaa act gct ctt cgt gag aag aag      480
Pro Ala Lys Ile Asp His Val Ile Lys Thr Ala Leu Arg Glu Lys Lys
145                 150                 155                 160

ccg gtt tat ctc gaa atc gct tgc aac att gct tcc atg ccc tgc gcc      528
Pro Val Tyr Leu Glu Ile Ala Cys Asn Ile Ala Ser Met Pro Cys Ala
                165                 170                 175

gct cct gga ccg gca agc gca ttg ttc aat gac gaa gcc agc gac gaa      576
Ala Pro Gly Pro Ala Ser Ala Leu Phe Asn Asp Glu Ala Ser Asp Glu
            180                 185                 190

gct tct ttg aat gca gcg gtt gaa gaa acc ctg aaa ttc atc gcc aac      624
Ala Ser Leu Asn Ala Ala Val Glu Glu Thr Leu Lys Phe Ile Ala Asn
        195                 200                 205

cgc gac aaa gtt gcc gtc ctc gtc ggc agc aag ctg cgc gca gct ggt      672
Arg Asp Lys Val Ala Val Leu Val Gly Ser Lys Leu Arg Ala Ala Gly
    210                 215                 220

gct gaa gaa gct gct gtc aaa ttt gct gat gct ctc ggt ggc gca gtt      720
Ala Glu Glu Ala Ala Val Lys Phe Ala Asp Ala Leu Gly Gly Ala Val
225                 230                 235                 240

gct acc atg gct gct gca aaa agc ttc ttc cca gaa gaa aac ccg cat      768
Ala Thr Met Ala Ala Ala Lys Ser Phe Phe Pro Glu Glu Asn Pro His
                245                 250                 255

tac atc ggc acc tca tgg ggt gaa gtc agc tat ccg ggc gtt gaa aag      816
Tyr Ile Gly Thr Ser Trp Gly Glu Val Ser Tyr Pro Gly Val Glu Lys
            260                 265                 270

acg atg aaa gaa gcc gat gcg gtt atc gct ctg gct cct gtc ttc aac      864
Thr Met Lys Glu Ala Asp Ala Val Ile Ala Leu Ala Pro Val Phe Asn
        275                 280                 285

gac tac tcc acc act ggt tgg acg gat att cct gat cct aag aaa ctg      912
Asp Tyr Ser Thr Thr Gly Trp Thr Asp Ile Pro Asp Pro Lys Lys Leu
    290                 295                 300
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gtt ctc gct gaa ccg cgt tct gtc gtc gtt aac ggc att cgc ttc ccc      960
Val Leu Ala Glu Pro Arg Ser Val Val Val Asn Gly Ile Arg Phe Pro
305                 310                 315                 320

agc gtc cat ctg aaa gac tat ctg acc cgt ttg gct cag aaa gtt tcc     1008
Ser Val His Leu Lys Asp Tyr Leu Thr Arg Leu Ala Gln Lys Val Ser
                325                 330                 335

aag aaa acc ggt gca ttg gac ttc ttc aaa tcc ctc aat gca ggt gaa     1056
Lys Lys Thr Gly Ala Leu Asp Phe Phe Lys Ser Leu Asn Ala Gly Glu
            340                 345                 350

ctg aag aaa gcc gct ccg gct gat ccg agt gct ccg ttg gtc aac gca     1104
Leu Lys Lys Ala Ala Pro Ala Asp Pro Ser Ala Pro Leu Val Asn Ala
        355                 360                 365

gaa atc gcc cgt cag gtc gaa gct ctt ctg acc ccg aac acg acg gtt     1152
Glu Ile Ala Arg Gln Val Glu Ala Leu Leu Thr Pro Asn Thr Thr Val
    370                 375                 380

att gct gaa acc ggt gac tct tgg ttc aat gct cag cgc atg aag ctc     1200
Ile Ala Glu Thr Gly Asp Ser Trp Phe Asn Ala Gln Arg Met Lys Leu
385                 390                 395                 400

ccg aac ggt gct cgc gtt gaa tat gaa atg cag tgg ggt cac att ggt     1248
Pro Asn Gly Ala Arg Val Glu Tyr Glu Met Gln Trp Gly His Ile Gly
                405                 410                 415

tgg tcc gtt cct gcc gcc ttc ggt tat gcc gtc ggt gct ccg gaa cgt     1296
Trp Ser Val Pro Ala Ala Phe Gly Tyr Ala Val Gly Ala Pro Glu Arg
            420                 425                 430

cgc aac atc ctc atg gtt ggt gat ggt tcc ttc cag ctg acg gct cag     1344
Arg Asn Ile Leu Met Val Gly Asp Gly Ser Phe Gln Leu Thr Ala Gln
        435                 440                 445

gaa gtc gct cag atg gtt cgc ctg aaa ctg ccg gtt atc atc ttc ttg     1392
Glu Val Ala Gln Met Val Arg Leu Lys Leu Pro Val Ile Ile Phe Leu
    450                 455                 460

atc aat aac tat ggt tac acc atc gaa gtt atg atc cat gat ggt ccg     1440
Ile Asn Asn Tyr Gly Tyr Thr Ile Glu Val Met Ile His Asp Gly Pro
465                 470                 475                 480

tac aac aac atc aag aac tgg gat tat gcc ggt ctg atg gaa gtg ttc     1488
Tyr Asn Asn Ile Lys Asn Trp Asp Tyr Ala Gly Leu Met Glu Val Phe
                485                 490                 495

aac ggt aac ggt ggt tat gac agc ggt gct ggt aaa ggc ctg aag gct     1536
Asn Gly Asn Gly Gly Tyr Asp Ser Gly Ala Gly Lys Gly Leu Lys Ala
            500                 505                 510

aaa acc ggt ggc gaa ctg gca gaa gct atc aag gtt gct ctg gca aac     1584
Lys Thr Gly Gly Glu Leu Ala Glu Ala Ile Lys Val Ala Leu Ala Asn
        515                 520                 525

acc gac ggc cca acc ctg atc gaa tgc ttc atc ggt cgt gaa gac tgc     1632
Thr Asp Gly Pro Thr Leu Ile Glu Cys Phe Ile Gly Arg Glu Asp Cys
    530                 535                 540
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act gaa gaa ttg gtc aaa tgg ggt aag cgc gtt gct gcc gcc aac agc 1680
Thr Glu Glu Leu Val Lys Trp Gly Lys Arg Val Ala Ala Ala Asn Ser
545 550 555 560

cgt aag cct gtt aac aag ctc ctc tag 1707
Arg Lys Pro Val Asn Lys Leu Leu
565

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<211> 568

<212> PRT

<213> Zymomonas mobilis

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20 25 30

Leu Asp Asn Leu Leu Leu Asn Lys Asn Met Glu Gln Val Tyr Cys Cys
35 40 45

Asn Glu Leu Asn Cys Gly Phe Ser Ala Glu Gly Tyr Ala Arg Ala Lys
50 55 60

Gly Ala Ala Ala Ala Val Val Thr Tyr Ser Val Gly Ala Leu Ser Ala
65 70 75 80

Phe Asp Ala Ile Gly Gly Ala Tyr Ala Glu Asn Leu Pro Val Ile Leu
85 90 95

Ile Ser Gly Ala Pro Asn Asn Asn Asp His Ala Ala Gly His Val Leu
100 105 110

His His Ala Leu Gly Lys Thr Asp Tyr His Tyr Gln Leu Glu Met Ala
115 120 125

Lys Asn Ile Thr Ala Ala Ala Glu Ala Ile Tyr Thr Pro Glu Glu Ala
130 135 140

Pro Ala Lys Ile Asp His Val Ile Lys Thr Ala Leu Arg Glu Lys Lys
145 150 155 160

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Pro Val Tyr Leu Glu Ile Ala Cys Asn Ile Ala Ser Met Pro Cys Ala
                165                 170                 175

Ala Pro Gly Pro Ala Ser Ala Leu Phe Asn Asp Glu Ala Ser Asp Glu
            180                 185                 190

Ala Ser Leu Asn Ala Ala Val Glu Glu Thr Leu Lys Phe Ile Ala Asn
        195                 200                 205

Arg Asp Lys Val Ala Val Leu Val Gly Ser Lys Leu Arg Ala Ala Gly
    210                 215                 220

Ala Glu Glu Ala Ala Val Lys Phe Ala Asp Ala Leu Gly Gly Ala Val
225                 230                 235                 240

Ala Thr Met Ala Ala Ala Lys Ser Phe Phe Pro Glu Glu Asn Pro His
                245                 250                 255

Tyr Ile Gly Thr Ser Trp Gly Glu Val Ser Tyr Pro Gly Val Glu Lys
            260                 265                 270

Thr Met Lys Glu Ala Asp Ala Val Ile Ala Leu Ala Pro Val Phe Asn
        275                 280                 285

Asp Tyr Ser Thr Thr Gly Trp Thr Asp Ile Pro Asp Pro Lys Lys Leu
    290                 295                 300

Val Leu Ala Glu Pro Arg Ser Val Val Val Asn Gly Ile Arg Phe Pro
305                 310                 315                 320

Ser Val His Leu Lys Asp Tyr Leu Thr Arg Leu Ala Gln Lys Val Ser
                325                 330                 335

Lys Lys Thr Gly Ala Leu Asp Phe Phe Lys Ser Leu Asn Ala Gly Glu
            340                 345                 350

Leu Lys Lys Ala Ala Pro Ala Asp Pro Ser Ala Pro Leu Val Asn Ala
        355                 360                 365

Glu Ile Ala Arg Gln Val Glu Ala Leu Leu Thr Pro Asn Thr Thr Val
    370                 375                 380

Ile Ala Glu Thr Gly Asp Ser Trp Phe Asn Ala Gln Arg Met Lys Leu
385                 390                 395                 400
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Pro Asn Gly Ala Arg Val Glu Tyr Glu Met Gln Trp Gly His Ile Gly
405 410 415

Trp Ser Val Pro Ala Ala Phe Gly Tyr Ala Val Gly Ala Pro Glu Arg
420 425 430

Arg Asn Ile Leu Met Val Gly Asp Gly Ser Phe Gln Leu Thr Ala Gln
435 440 445

Glu Val Ala Gln Met Val Arg Leu Lys Leu Pro Val Ile Ile Phe Leu
450 455 460

Ile Asn Asn Tyr Gly Tyr Thr Ile Glu Val Met Ile His Asp Gly Pro
465 470 475 480

Tyr Asn Asn Ile Lys Asn Trp Asp Tyr Ala Gly Leu Met Glu Val Phe
485 490 495

Asn Gly Asn Gly Gly Tyr Asp Ser Gly Ala Gly Lys Gly Leu Lys Ala
500 505 510

Lys Thr Gly Gly Glu Leu Ala Glu Ala Ile Lys Val Ala Leu Ala Asn
515 520 525

Thr Asp Gly Pro Thr Leu Ile Glu Cys Phe Ile Gly Arg Glu Asp Cys
530 535 540

Thr Glu Glu Leu Val Lys Trp Gly Lys Arg Val Ala Ala Ala Asn Ser
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Arg Lys Pro Val Asn Lys Leu Leu
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1               5                  10                  15

gtc aac gtt aac acc gtt ttc ggt ttg cca ggt gac ttc aac ttg tcc       96
Val Asn Val Asn Thr Val Phe Gly Leu Pro Gly Asp Phe Asn Leu Ser
            20                  25                  30

ttg ttg gac aag atc tac gaa gtt gaa ggt atg aga tgg gct ggt aac      144
Leu Leu Asp Lys Ile Tyr Glu Val Glu Gly Met Arg Trp Ala Gly Asn
        35                  40                  45

gcc aac gaa ttg aac gct gct tac gcc gct gat ggt tac gct cgt atc      192
Ala Asn Glu Leu Asn Ala Ala Tyr Ala Ala Asp Gly Tyr Ala Arg Ile
    50                  55                  60

aag ggt atg tct tgt atc atc acc acc ttc ggt gtc ggt gaa ttg tct      240
Lys Gly Met Ser Cys Ile Ile Thr Thr Phe Gly Val Gly Glu Leu Ser
65                  70                  75                  80

gct ttg aac ggt att gcc ggt tct tac gct gaa cac gtc ggt gtt ttg      288
Ala Leu Asn Gly Ile Ala Gly Ser Tyr Ala Glu His Val Gly Val Leu
                85                  90                  95

cac gtt gtt ggt gtc cca tcc atc tct gct caa gct aag caa ttg ttg      336
His Val Val Gly Val Pro Ser Ile Ser Ala Gln Ala Lys Gln Leu Leu
            100                 105                 110

ttg cac cac acc ttg ggt aac ggt gac ttc act gtt ttc cac aga atg      384
Leu His His Thr Leu Gly Asn Gly Asp Phe Thr Val Phe His Arg Met
        115                 120                 125

tct gcc aac att tct gaa acc act gct atg atc act gac att gct acc      432
Ser Ala Asn Ile Ser Glu Thr Thr Ala Met Ile Thr Asp Ile Ala Thr
    130                 135                 140

gcc cca gct gaa att gac aga tgt atc aga acc act tac gtc acc caa      480
Ala Pro Ala Glu Ile Asp Arg Cys Ile Arg Thr Thr Tyr Val Thr Gln
145                 150                 155                 160

aga cca gtc tac tta ggt ttg cca gct aac ttg gtc gac ttg aac gtc      528
Arg Pro Val Tyr Leu Gly Leu Pro Ala Asn Leu Val Asp Leu Asn Val
                165                 170                 175

cca gct aag ttg ttg caa act cca att gac atg tct ttg aag cca aac      576
Pro Ala Lys Leu Leu Gln Thr Pro Ile Asp Met Ser Leu Lys Pro Asn
            180                 185                 190

gat gct gaa tcc gaa aag gaa gtc att gac acc atc ttg gct ttg gtc      624
Asp Ala Glu Ser Glu Lys Glu Val Ile Asp Thr Ile Leu Ala Leu Val
        195                 200                 205

aag gat gct aag aac cca gtt atc ttg gct gat gct tgt tgt tcc aga      672
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Lys Asp Ala Lys Asn Pro Val Ile Leu Ala Asp Ala Cys Cys Ser Arg
    210                 215                 220

cac gac gtc aag gct gaa act aag aag ttg att gac ttg act caa ttc      720
His Asp Val Lys Ala Glu Thr Lys Lys Leu Ile Asp Leu Thr Gln Phe
225                 230                 235                 240

cca gct ttc gtc acc cca atg ggt aag ggt tcc att gac gaa caa cac      768
Pro Ala Phe Val Thr Pro Met Gly Lys Gly Ser Ile Asp Glu Gln His
                245                 250                 255

cca aga tac ggt ggt gtt tac gtc ggt acc ttg tcc aag cca gaa gtt      816
Pro Arg Tyr Gly Gly Val Tyr Val Gly Thr Leu Ser Lys Pro Glu Val
            260                 265                 270

aag gaa gcc gtt gaa tct gct gac ttg att ttg tct gtc ggt gct ttg      864
Lys Glu Ala Val Glu Ser Ala Asp Leu Ile Leu Ser Val Gly Ala Leu
        275                 280                 285

ttg tct gat ttc aac acc ggt tct ttc tct tac tct tac aag acc aag      912
Leu Ser Asp Phe Asn Thr Gly Ser Phe Ser Tyr Ser Tyr Lys Thr Lys
    290                 295                 300

aac att gtc gaa ttc cac tcc gac cac atg aag atc aga aac gcc act      960
Asn Ile Val Glu Phe His Ser Asp His Met Lys Ile Arg Asn Ala Thr
305                 310                 315                 320

ttc cca ggt gtc caa atg aaa ttc gtt ttg caa aag ttg ttg acc act     1008
Phe Pro Gly Val Gln Met Lys Phe Val Leu Gln Lys Leu Leu Thr Thr
                325                 330                 335

att gct gac gcc gct aag ggt tac aag cca gtt gct gtc cca gct aga     1056
Ile Ala Asp Ala Ala Lys Gly Tyr Lys Pro Val Ala Val Pro Ala Arg
            340                 345                 350

act cca gct aac gct gct gtc cca gct tct acc cca ttg aag caa gaa     1104
Thr Pro Ala Asn Ala Ala Val Pro Ala Ser Thr Pro Leu Lys Gln Glu
        355                 360                 365

tgg atg tgg aac caa ttg ggt aac ttc ttg caa gaa ggt gat gtt gtc     1152
Trp Met Trp Asn Gln Leu Gly Asn Phe Leu Gln Glu Gly Asp Val Val
    370                 375                 380

att gct gaa acc ggt acc tcc gct ttc ggt atc aac caa acc act ttc     1200
Ile Ala Glu Thr Gly Thr Ser Ala Phe Gly Ile Asn Gln Thr Thr Phe
385                 390                 395                 400

cca aac aac acc tac ggt atc tct caa gtc tta tgg ggt tcc att ggt     1248
Pro Asn Asn Thr Tyr Gly Ile Ser Gln Val Leu Trp Gly Ser Ile Gly
                405                 410                 415

ttc acc act ggt gct acc ttg ggt gct gct ttc gct gct gaa gaa att     1296
Phe Thr Thr Gly Ala Thr Leu Gly Ala Ala Phe Ala Ala Glu Glu Ile
            420                 425                 430

gat cca aag aag aga gtt atc tta ttc att ggt gac ggt tct ttg caa     1344
Asp Pro Lys Lys Arg Val Ile Leu Phe Ile Gly Asp Gly Ser Leu Gln
        435                 440                 445

ttg act gtt caa gaa atc tcc acc atg atc aga tgg ggc ttg aag cca     1392
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Leu Thr Val Gln Glu Ile Ser Thr Met Ile Arg Trp Gly Leu Lys Pro
    450                 455                 460

tac ttg ttc gtc ttg aac aac gat ggt tac acc att gaa aag ttg att     1440
Tyr Leu Phe Val Leu Asn Asn Asp Gly Tyr Thr Ile Glu Lys Leu Ile
465                 470                 475                 480

cac ggt cca aag gct caa tac aac gaa att caa ggt tgg gac cac cta     1488
His Gly Pro Lys Ala Gln Tyr Asn Glu Ile Gln Gly Trp Asp His Leu
                485                 490                 495

tcc ttg ttg cca act ttc ggt gct aag gac tat gaa acc cac aga gtc     1536
Ser Leu Leu Pro Thr Phe Gly Ala Lys Asp Tyr Glu Thr His Arg Val
            500                 505                 510

gct acc acc ggt gaa tgg gac aag ttg acc caa gac aag tct ttc aac     1584
Ala Thr Thr Gly Glu Trp Asp Lys Leu Thr Gln Asp Lys Ser Phe Asn
        515                 520                 525

gac aac tct aag atc aga atg att gaa atc atg ttg cca gtc ttc gat     1632
Asp Asn Ser Lys Ile Arg Met Ile Glu Ile Met Leu Pro Val Phe Asp
    530                 535                 540

gct cca caa aac ttg gtt gaa caa gct aag ttg act gct gct acc aac     1680
Ala Pro Gln Asn Leu Val Glu Gln Ala Lys Leu Thr Ala Ala Thr Asn
545                 550                 555                 560

gct aag caa taa                                                    1692
Ala Lys Gln
```

<210> 21

<211> 563

<212> PRT

<213> Saccharomyces cerevisiae

<400> 21

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Met Ser Glu Ile Thr Leu Gly Lys Tyr Leu Phe Glu Arg Leu Lys Gln
1               5                   10                  15

Val Asn Val Asn Thr Val Phe Gly Leu Pro Gly Asp Phe Asn Leu Ser
            20                  25                  30

Leu Leu Asp Lys Ile Tyr Glu Val Glu Gly Met Arg Trp Ala Gly Asn
        35                  40                  45

Ala Asn Glu Leu Asn Ala Ala Tyr Ala Ala Asp Gly Tyr Ala Arg Ile
    50                  55                  60
```

```
Lys Gly Met Ser Cys Ile Ile Thr Thr Phe Gly Val Gly Glu Leu Ser
65                  70                  75                  80

Ala Leu Asn Gly Ile Ala Gly Ser Tyr Ala Glu His Val Gly Val Leu
                85                  90                  95

His Val Val Gly Val Pro Ser Ile Ser Ala Gln Ala Lys Gln Leu Leu
            100                 105                 110

Leu His His Thr Leu Gly Asn Gly Asp Phe Thr Val Phe His Arg Met
        115                 120                 125

Ser Ala Asn Ile Ser Glu Thr Thr Ala Met Ile Thr Asp Ile Ala Thr
    130                 135                 140

Ala Pro Ala Glu Ile Asp Arg Cys Ile Arg Thr Thr Tyr Val Thr Gln
145                 150                 155                 160

Arg Pro Val Tyr Leu Gly Leu Pro Ala Asn Leu Val Asp Leu Asn Val
                165                 170                 175

Pro Ala Lys Leu Leu Gln Thr Pro Ile Asp Met Ser Leu Lys Pro Asn
            180                 185                 190

Asp Ala Glu Ser Glu Lys Glu Val Ile Asp Thr Ile Leu Ala Leu Val
        195                 200                 205

Lys Asp Ala Lys Asn Pro Val Ile Leu Ala Asp Ala Cys Cys Ser Arg
    210                 215                 220

His Asp Val Lys Ala Glu Thr Lys Lys Leu Ile Asp Leu Thr Gln Phe
225                 230                 235                 240

Pro Ala Phe Val Thr Pro Met Gly Lys Gly Ser Ile Asp Glu Gln His
                245                 250                 255

Pro Arg Tyr Gly Gly Val Tyr Val Gly Thr Leu Ser Lys Pro Glu Val
            260                 265                 270

Lys Glu Ala Val Glu Ser Ala Asp Leu Ile Leu Ser Val Gly Ala Leu
        275                 280                 285

Leu Ser Asp Phe Asn Thr Gly Ser Phe Ser Tyr Ser Tyr Lys Thr Lys
    290                 295                 300
```

```
Asn Ile Val Glu Phe His Ser Asp His Met Lys Ile Arg Asn Ala Thr
305                 310                 315                 320

Phe Pro Gly Val Gln Met Lys Phe Val Leu Gln Lys Leu Leu Thr Thr
                325                 330                 335

Ile Ala Asp Ala Ala Lys Gly Tyr Lys Pro Val Ala Val Pro Ala Arg
            340                 345                 350

Thr Pro Ala Asn Ala Ala Val Pro Ala Ser Thr Pro Leu Lys Gln Glu
        355                 360                 365

Trp Met Trp Asn Gln Leu Gly Asn Phe Leu Gln Glu Gly Asp Val Val
    370                 375                 380

Ile Ala Glu Thr Gly Thr Ser Ala Phe Gly Ile Asn Gln Thr Thr Phe
385                 390                 395                 400

Pro Asn Asn Thr Tyr Gly Ile Ser Gln Val Leu Trp Gly Ser Ile Gly
                405                 410                 415

Phe Thr Thr Gly Ala Thr Leu Gly Ala Ala Phe Ala Ala Glu Glu Ile
            420                 425                 430

Asp Pro Lys Lys Arg Val Ile Leu Phe Ile Gly Asp Gly Ser Leu Gln
        435                 440                 445

Leu Thr Val Gln Glu Ile Ser Thr Met Ile Arg Trp Gly Leu Lys Pro
    450                 455                 460

Tyr Leu Phe Val Leu Asn Asn Asp Gly Tyr Thr Ile Glu Lys Leu Ile
465                 470                 475                 480

His Gly Pro Lys Ala Gln Tyr Asn Glu Ile Gln Gly Trp Asp His Leu
                485                 490                 495

Ser Leu Leu Pro Thr Phe Gly Ala Lys Asp Tyr Glu Thr His Arg Val
            500                 505                 510

Ala Thr Thr Gly Glu Trp Asp Lys Leu Thr Gln Asp Lys Ser Phe Asn
        515                 520                 525

Asp Asn Ser Lys Ile Arg Met Ile Glu Ile Met Leu Pro Val Phe Asp
    530                 535                 540
```

Ala Pro Gln Asn Leu Val Glu Gln Ala Lys Leu Thr Ala Ala Thr Asn
545 550 555 560

Ala Lys Gln

<210> 22

<211> 33

<212> DNA

<213> artificial sequence

<220>

<223> artificial sequence

<400> 22
tctttaatta atgggttgtc cgtcattcat ata 33

<210> 23

<211> 32

<212> DNA

<213> artificial sequence

<220>

<223> artificial sequence

<400> 23
ctaaagcttt taggccagag tggtcttgcg cg 32

<210> 24

<211> 1674

<212> DNA

<213> Acetobacter pasteurianus

<220>

<221> CDS

<222> (1)..(1674)

<223>

<400> 24

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gtg acc tat act gtt ggc atg tat ctt gca gaa cgc ctt gta cag atc       48
Val Thr Tyr Thr Val Gly Met Tyr Leu Ala Glu Arg Leu Val Gln Ile
1               5                   10                  15

ggg ctg aag cat cac ttc gcc gtg ggc ggc gac tac aat ctc gtt ctt       96
Gly Leu Lys His His Phe Ala Val Gly Gly Asp Tyr Asn Leu Val Leu
            20                  25                  30

ctg gat cag ttg ctc ctc aac aag gac atg aaa cag atc tat tgc tgc      144
Leu Asp Gln Leu Leu Leu Asn Lys Asp Met Lys Gln Ile Tyr Cys Cys
        35                  40                  45

aat gag ttg aac tgt ggc ttc agc gcg gaa ggc tac gcc cgt tct aac      192
Asn Glu Leu Asn Cys Gly Phe Ser Ala Glu Gly Tyr Ala Arg Ser Asn
    50                  55                  60

ggg gct gcg gca gcg gtt gtc acc ttc agc gtt ggc gcc att tcc gcc      240
Gly Ala Ala Ala Ala Val Val Thr Phe Ser Val Gly Ala Ile Ser Ala
65                  70                  75                  80

atg aac gcc ctc ggc ggc gcc tat gcc gaa aac ctg ccg gtt atc ctg      288
Met Asn Ala Leu Gly Gly Ala Tyr Ala Glu Asn Leu Pro Val Ile Leu
                85                  90                  95

att tcc ggc gcg ccc aac agc aat gat cag ggc aca ggt cat atc ctg      336
Ile Ser Gly Ala Pro Asn Ser Asn Asp Gln Gly Thr Gly His Ile Leu
            100                 105                 110

cat cac aca atc ggc aag acg gat tac agc tac cag ctt gaa atg gcc      384
His His Thr Ile Gly Lys Thr Asp Tyr Ser Tyr Gln Leu Glu Met Ala
        115                 120                 125

cgt cag gtc acc tgt gcc gcc gaa agc att acc gac gct cac tcc gcc      432
Arg Gln Val Thr Cys Ala Ala Glu Ser Ile Thr Asp Ala His Ser Ala
    130                 135                 140

ccg gcc aag att gac cac gtc att cgc acg gcg ctg cgc gag cgt aag      480
Pro Ala Lys Ile Asp His Val Ile Arg Thr Ala Leu Arg Glu Arg Lys
145                 150                 155                 160

ccg gcc tat ctg gac atc gcg tgc aac att gcc tcc gag ccc tgc gtg      528
Pro Ala Tyr Leu Asp Ile Ala Cys Asn Ile Ala Ser Glu Pro Cys Val
                165                 170                 175

cgg cct ggc cct gtc agc agc ctg ctg tcc gag cct gaa atc gac cac      576
Arg Pro Gly Pro Val Ser Ser Leu Leu Ser Glu Pro Glu Ile Asp His
            180                 185                 190

acg agc ctg aag gcc gca gtg gac gcc acg gtt gcc ttg ctg aaa aat      624
Thr Ser Leu Lys Ala Ala Val Asp Ala Thr Val Ala Leu Leu Lys Asn
        195                 200                 205

cgg cca gcc ccc gtc atg ctg ctg ggc agc aag ctg cgg gcc gcc aac      672
Arg Pro Ala Pro Val Met Leu Leu Gly Ser Lys Leu Arg Ala Ala Asn
    210                 215                 220
```

```
gca ctg gcc gca acc gaa acg ctg gca gac aag ctg caa tgc gcg gtg      720
Ala Leu Ala Ala Thr Glu Thr Leu Ala Asp Lys Leu Gln Cys Ala Val
225                 230                 235                 240

acc atc atg gcg gcc gcg aaa ggc ttt ttc ccc gaa gac cac gcg ggt      768
Thr Ile Met Ala Ala Ala Lys Gly Phe Phe Pro Glu Asp His Ala Gly
                245                 250                 255

ttc cgc ggc ctg tac tgg ggc gaa gtc tcg aac ccc ggc gtg cag gaa      816
Phe Arg Gly Leu Tyr Trp Gly Glu Val Ser Asn Pro Gly Val Gln Glu
            260                 265                 270

ctg gtg gag acc tcc gac gca ctg ctg tgc atc gcc ccc gta ttc aac      864
Leu Val Glu Thr Ser Asp Ala Leu Leu Cys Ile Ala Pro Val Phe Asn
        275                 280                 285

gac tat tca aca gtc ggc tgg tcg ggc atg ccc aag ggc ccc aat gtg      912
Asp Tyr Ser Thr Val Gly Trp Ser Gly Met Pro Lys Gly Pro Asn Val
    290                 295                 300

att ctg gct gag ccc gac cgc gta acg gtc gat ggc cgc gcc tat gac      960
Ile Leu Ala Glu Pro Asp Arg Val Thr Val Asp Gly Arg Ala Tyr Asp
305                 310                 315                 320

ggc ttt acc ctg cgc gcc ttc ctg cag gct ctg gcg gaa aaa gcc ccc     1008
Gly Phe Thr Leu Arg Ala Phe Leu Gln Ala Leu Ala Glu Lys Ala Pro
                325                 330                 335

gcg cgc ccg gcc tcc gca cag aaa agc agc gtc ccg acg tgc tcg ctc     1056
Ala Arg Pro Ala Ser Ala Gln Lys Ser Ser Val Pro Thr Cys Ser Leu
            340                 345                 350

acc gcg aca tcc gat gaa gcc ggt ctg acg aat gac gaa atc gtc cgt     1104
Thr Ala Thr Ser Asp Glu Ala Gly Leu Thr Asn Asp Glu Ile Val Arg
        355                 360                 365

cat atc aac gcc ctg ctg aca tca aac acg acg ctg gtg gca gaa acc     1152
His Ile Asn Ala Leu Leu Thr Ser Asn Thr Thr Leu Val Ala Glu Thr
    370                 375                 380

ggc gat tca tgg ttc aat gcc atg cgc atg acc ctg gcc ggt gcg cgc     1200
Gly Asp Ser Trp Phe Asn Ala Met Arg Met Thr Leu Ala Gly Ala Arg
385                 390                 395                 400

gtg gaa ctg gaa atg cag tgg ggc cat atc ggc tgg tcc gtg ccc tcc     1248
Val Glu Leu Glu Met Gln Trp Gly His Ile Gly Trp Ser Val Pro Ser
                405                 410                 415

gcg ttc ggc aat gcc atg ggc tcg cag gac cgc cag cat gtg gtg atg     1296
Ala Phe Gly Asn Ala Met Gly Ser Gln Asp Arg Gln His Val Val Met
            420                 425                 430

gta ggc gat ggc tcc ttc cag ctt acc gcg cag gaa gtg gct cag atg     1344
Val Gly Asp Gly Ser Phe Gln Leu Thr Ala Gln Glu Val Ala Gln Met
        435                 440                 445

gtg cgc tac gaa ctg ccc gtc att atc ttt ctg atc aac aac cgt ggc     1392
Val Arg Tyr Glu Leu Pro Val Ile Ile Phe Leu Ile Asn Asn Arg Gly
    450                 455                 460
```

```
tat gtc att gaa atc gcc att cat gac ggc ccg tac aac tat atc aag     1440
Tyr Val Ile Glu Ile Ala Ile His Asp Gly Pro Tyr Asn Tyr Ile Lys
465                 470                 475                 480

aac tgg gat tac gcc ggc ctg atg gaa gtc ttc aac gcc gga gaa ggc     1488
Asn Trp Asp Tyr Ala Gly Leu Met Glu Val Phe Asn Ala Gly Glu Gly
                485                 490                 495

cat gga ctt ggc ctg aaa gcc acc acc ccg aag gaa ctg aca gaa gcc     1536
His Gly Leu Gly Leu Lys Ala Thr Thr Pro Lys Glu Leu Thr Glu Ala
            500                 505                 510

atc gcc agg gca aaa gcc aat acc cgc ggc ccg acg ctg atc gaa tgc     1584
Ile Ala Arg Ala Lys Ala Asn Thr Arg Gly Pro Thr Leu Ile Glu Cys
        515                 520                 525

cag atc gac cgc acg gac tgc acg gat atg ctg gtt caa tgg ggc cgc     1632
Gln Ile Asp Arg Thr Asp Cys Thr Asp Met Leu Val Gln Trp Gly Arg
    530                 535                 540

aag gtt gcc tca acc aac gcg cgc aag acc act ctg gcc tga             1674
Lys Val Ala Ser Thr Asn Ala Arg Lys Thr Thr Leu Ala
545                 550                 555
```

<210> 25

<211> 557

<212> PRT

<213> Acetobacter pasteurianus

<400> 25

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Val Thr Tyr Thr Val Gly Met Tyr Leu Ala Glu Arg Leu Val Gln Ile
1               5                   10                  15

Gly Leu Lys His His Phe Ala Val Gly Gly Asp Tyr Asn Leu Val Leu
            20                  25                  30

Leu Asp Gln Leu Leu Leu Asn Lys Asp Met Lys Gln Ile Tyr Cys Cys
        35                  40                  45

Asn Glu Leu Asn Cys Gly Phe Ser Ala Glu Gly Tyr Ala Arg Ser Asn
    50                  55                  60

Gly Ala Ala Ala Ala Val Val Thr Phe Ser Val Gly Ala Ile Ser Ala
65                  70                  75                  80

Met Asn Ala Leu Gly Gly Ala Tyr Ala Glu Asn Leu Pro Val Ile Leu
                85                  90                  95
```

```
Ile Ser Gly Ala Pro Asn Ser Asn Asp Gln Gly Thr Gly His Ile Leu
            100                 105                 110

His His Thr Ile Gly Lys Thr Asp Tyr Ser Tyr Gln Leu Glu Met Ala
        115                 120                 125

Arg Gln Val Thr Cys Ala Ala Glu Ser Ile Thr Asp Ala His Ser Ala
    130                 135                 140

Pro Ala Lys Ile Asp His Val Ile Arg Thr Ala Leu Arg Glu Arg Lys
145                 150                 155                 160

Pro Ala Tyr Leu Asp Ile Ala Cys Asn Ile Ala Ser Glu Pro Cys Val
                165                 170                 175

Arg Pro Gly Pro Val Ser Ser Leu Leu Ser Glu Pro Glu Ile Asp His
            180                 185                 190

Thr Ser Leu Lys Ala Ala Val Asp Ala Thr Val Ala Leu Leu Lys Asn
        195                 200                 205

Arg Pro Ala Pro Val Met Leu Leu Gly Ser Lys Leu Arg Ala Ala Asn
    210                 215                 220

Ala Leu Ala Ala Thr Glu Thr Leu Ala Asp Lys Leu Gln Cys Ala Val
225                 230                 235                 240

Thr Ile Met Ala Ala Ala Lys Gly Phe Phe Pro Glu Asp His Ala Gly
                245                 250                 255

Phe Arg Gly Leu Tyr Trp Gly Glu Val Ser Asn Pro Gly Val Gln Glu
            260                 265                 270

Leu Val Glu Thr Ser Asp Ala Leu Leu Cys Ile Ala Pro Val Phe Asn
        275                 280                 285

Asp Tyr Ser Thr Val Gly Trp Ser Gly Met Pro Lys Gly Pro Asn Val
    290                 295                 300

Ile Leu Ala Glu Pro Asp Arg Val Thr Val Asp Gly Arg Ala Tyr Asp
305                 310                 315                 320

Gly Phe Thr Leu Arg Ala Phe Leu Gln Ala Leu Ala Glu Lys Ala Pro
                325                 330                 335
```

```
Ala Arg Pro Ala Ser Ala Gln Lys Ser Ser Val Pro Thr Cys Ser Leu
            340                 345                 350

Thr Ala Thr Ser Asp Glu Ala Gly Leu Thr Asn Asp Glu Ile Val Arg
        355                 360                 365

His Ile Asn Ala Leu Leu Thr Ser Asn Thr Thr Leu Val Ala Glu Thr
    370                 375                 380

Gly Asp Ser Trp Phe Asn Ala Met Arg Met Thr Leu Ala Gly Ala Arg
385                 390                 395                 400

Val Glu Leu Glu Met Gln Trp Gly His Ile Gly Trp Ser Val Pro Ser
                405                 410                 415

Ala Phe Gly Asn Ala Met Gly Ser Gln Asp Arg Gln His Val Val Met
            420                 425                 430

Val Gly Asp Gly Ser Phe Gln Leu Thr Ala Gln Glu Val Ala Gln Met
        435                 440                 445

Val Arg Tyr Glu Leu Pro Val Ile Ile Phe Leu Ile Asn Asn Arg Gly
    450                 455                 460

Tyr Val Ile Glu Ile Ala Ile His Asp Gly Pro Tyr Asn Tyr Ile Lys
465                 470                 475                 480

Asn Trp Asp Tyr Ala Gly Leu Met Glu Val Phe Asn Ala Gly Glu Gly
                485                 490                 495

His Gly Leu Gly Leu Lys Ala Thr Thr Pro Lys Glu Leu Thr Glu Ala
            500                 505                 510

Ile Ala Arg Ala Lys Ala Asn Thr Arg Gly Pro Thr Leu Ile Glu Cys
        515                 520                 525

Gln Ile Asp Arg Thr Asp Cys Thr Asp Met Leu Val Gln Trp Gly Arg
    530                 535                 540

Lys Val Ala Ser Thr Asn Ala Arg Lys Thr Thr Leu Ala
545                 550                 555
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<210> 26

<211> 32

<212> DNA

<213> artificial sequence

<220>

<223> artificial sequence

<400> 26
atcttaatta atgtataccg ttggtatgta ct 32

<210> 27

<211> 34

<212> DNA

<213> artificial sequence

<220>

<223> artificial sequence

<400> 27
tatgcggccg cttacgcttg tggtttgcga gagt 34

<210> 28

<211> 1671

<212> DNA

<213> Zymobacter palmae

<220>

<221> CDS

<222> (1)..(1671)

<223>

<400> 28
atg tat acc gtt ggt atg tac ttg gca gaa cgc cta gcc cag atc ggc 48
Met Tyr Thr Val Gly Met Tyr Leu Ala Glu Arg Leu Ala Gln Ile Gly
1 5 10 15

ctg aaa cac cac ttt gcc gtg gcc ggt gac tac aac ctg gtg ttg ctt 96

```
Leu Lys His His Phe Ala Val Ala Gly Asp Tyr Asn Leu Val Leu Leu
            20                  25                  30

gat cag ctc ctg ctg aac aaa gac atg gag cag gtc tac tgc tgt aac      144
Asp Gln Leu Leu Leu Asn Lys Asp Met Glu Gln Val Tyr Cys Cys Asn
        35                  40                  45

gaa ctt aac tgc ggc ttt agc gcc gaa ggt tac gct cgt gca cgt ggt      192
Glu Leu Asn Cys Gly Phe Ser Ala Glu Gly Tyr Ala Arg Ala Arg Gly
    50                  55                  60

gcc gcc gct gcc atc gtc acg ttc agc gta ggt gct atc tct gca atg      240
Ala Ala Ala Ala Ile Val Thr Phe Ser Val Gly Ala Ile Ser Ala Met
65                  70                  75                  80

aac gcc atc ggt ggc gcc tat gca gaa aac ctg ccg gtc atc ctg atc      288
Asn Ala Ile Gly Gly Ala Tyr Ala Glu Asn Leu Pro Val Ile Leu Ile
                85                  90                  95

tct ggc tca ccg aac acc aat gac tac ggc aca ggc cac atc ctg cac      336
Ser Gly Ser Pro Asn Thr Asn Asp Tyr Gly Thr Gly His Ile Leu His
            100                 105                 110

cac acc att ggt act act gac tat aac tat cag ctg gaa atg gta aaa      384
His Thr Ile Gly Thr Thr Asp Tyr Asn Tyr Gln Leu Glu Met Val Lys
        115                 120                 125

cac gtt acc tgc gca cgt gaa agc atc gtt tct gcc gaa gaa gca ccg      432
His Val Thr Cys Ala Arg Glu Ser Ile Val Ser Ala Glu Glu Ala Pro
    130                 135                 140

gca aaa atc gac cac gtc atc cgt acg gct cta cgt gaa cgc aaa ccg      480
Ala Lys Ile Asp His Val Ile Arg Thr Ala Leu Arg Glu Arg Lys Pro
145                 150                 155                 160

gct tat ctg gaa atc gca tgc aac gtc gct ggc gct gaa tgt gtt cgt      528
Ala Tyr Leu Glu Ile Ala Cys Asn Val Ala Gly Ala Glu Cys Val Arg
                165                 170                 175

ccg ggc ccg atc aat agc ctg ctg cgt gaa ctc gaa gtt gac cag acc      576
Pro Gly Pro Ile Asn Ser Leu Leu Arg Glu Leu Glu Val Asp Gln Thr
            180                 185                 190

agt gtc act gcc gct gta gat gcc gcc gta gaa tgg ctg cag gac cgc      624
Ser Val Thr Ala Ala Val Asp Ala Ala Val Glu Trp Leu Gln Asp Arg
        195                 200                 205

cag aac gtc gtc atg ctg gtc ggt agc aaa ctg cgt gcc gct gcc gct      672
Gln Asn Val Val Met Leu Val Gly Ser Lys Leu Arg Ala Ala Ala Ala
    210                 215                 220

gaa aaa cag gct gtt gcc cta gcg gac cgc ctg ggc tgc gct gtc acg      720
Glu Lys Gln Ala Val Ala Leu Ala Asp Arg Leu Gly Cys Ala Val Thr
225                 230                 235                 240

atc atg gct gcc gaa aaa ggc ttc ttc ccg gaa gat cat ccg aac ttc      768
Ile Met Ala Ala Glu Lys Gly Phe Phe Pro Glu Asp His Pro Asn Phe
                245                 250                 255

cgc ggc ctg tac tgg ggt gaa gtc agc tcc gaa ggt gca cag gaa ctg      816
```

```
Arg Gly Leu Tyr Trp Gly Glu Val Ser Ser Glu Gly Ala Gln Glu Leu
            260                 265                 270

gtt gaa aac gcc gat gcc atc ctg tgt ctg gca ccg gta ttc aac gac      864
Val Glu Asn Ala Asp Ala Ile Leu Cys Leu Ala Pro Val Phe Asn Asp
        275                 280                 285

tat gct acc gtt ggc tgg aac tcc tgg ccg aaa ggc gac aat gtc atg      912
Tyr Ala Thr Val Gly Trp Asn Ser Trp Pro Lys Gly Asp Asn Val Met
    290                 295                 300

gtc atg gac acc gac cgc gtc act ttc gca gga cag tcc ttc gaa ggt      960
Val Met Asp Thr Asp Arg Val Thr Phe Ala Gly Gln Ser Phe Glu Gly
305                 310                 315                 320

ctg tca ttg agc acc ttc gcc gca gca ctg gct gag aaa gca cct tct     1008
Leu Ser Leu Ser Thr Phe Ala Ala Ala Leu Ala Glu Lys Ala Pro Ser
                325                 330                 335

cgc ccg gca acg act caa ggc act caa gca ccg gta ctg ggt att gag     1056
Arg Pro Ala Thr Thr Gln Gly Thr Gln Ala Pro Val Leu Gly Ile Glu
            340                 345                 350

gcc gca gag ccc aat gca ccg ctg acc aat gac gaa atg acg cgt cag     1104
Ala Ala Glu Pro Asn Ala Pro Leu Thr Asn Asp Glu Met Thr Arg Gln
        355                 360                 365

atc cag tcg ctg atc act tcc gac act act ctg aca gca gaa aca ggt     1152
Ile Gln Ser Leu Ile Thr Ser Asp Thr Thr Leu Thr Ala Glu Thr Gly
    370                 375                 380

gac tct tgg ttc aac gct tct cgc atg ccg att cct ggc ggt gct cgt     1200
Asp Ser Trp Phe Asn Ala Ser Arg Met Pro Ile Pro Gly Gly Ala Arg
385                 390                 395                 400

gtc gaa ctg gaa atg caa tgg ggt cat atc ggt tgg tcc gta cct tct     1248
Val Glu Leu Glu Met Gln Trp Gly His Ile Gly Trp Ser Val Pro Ser
                405                 410                 415

gca ttc ggt aac gcc gtt ggt tct ccg gag cgt cgc cac atc atg atg     1296
Ala Phe Gly Asn Ala Val Gly Ser Pro Glu Arg Arg His Ile Met Met
            420                 425                 430

gtc ggt gat ggc tct ttc cag ctg act gct caa gaa gtt gct cag atg     1344
Val Gly Asp Gly Ser Phe Gln Leu Thr Ala Gln Glu Val Ala Gln Met
        435                 440                 445

atc cgc tat gaa atc ccg gtc atc atc ttc ctg atc aac aac cgc ggt     1392
Ile Arg Tyr Glu Ile Pro Val Ile Ile Phe Leu Ile Asn Asn Arg Gly
    450                 455                 460

tac gtc atc gaa atc gct atc cat gac ggc cct tac aac tac atc aaa     1440
Tyr Val Ile Glu Ile Ala Ile His Asp Gly Pro Tyr Asn Tyr Ile Lys
465                 470                 475                 480

aac tgg aac tac gct ggc ctg atc gac gtc ttc aat gac gaa gat ggt     1488
Asn Trp Asn Tyr Ala Gly Leu Ile Asp Val Phe Asn Asp Glu Asp Gly
                485                 490                 495

cat ggc ctg ggt ctg aaa gct tct act ggt gca gaa cta gaa ggc gct     1536
```

```
His Gly Leu Gly Leu Lys Ala Ser Thr Gly Ala Glu Leu Glu Gly Ala
            500                 505                 510

atc aag aaa gca ctc gac aat cgt cgc ggt ccg acg ctg atc gaa tgt     1584
Ile Lys Lys Ala Leu Asp Asn Arg Arg Gly Pro Thr Leu Ile Glu Cys
        515                 520                 525

aac atc gct cag gac gac tgc act gaa acc ctg att gct tgg ggt aaa     1632
Asn Ile Ala Gln Asp Asp Cys Thr Glu Thr Leu Ile Ala Trp Gly Lys
    530                 535                 540

cgt gta gca gct acc aac tct cgc aaa cca caa gcg taa                 1671
Arg Val Ala Ala Thr Asn Ser Arg Lys Pro Gln Ala
545                 550                 555
```

<210> 29

<211> 556

<212> PRT

<213> Zymobacter palmae

<400> 29

```
Met Tyr Thr Val Gly Met Tyr Leu Ala Glu Arg Leu Ala Gln Ile Gly
1               5                   10                  15

Leu Lys His His Phe Ala Val Ala Gly Asp Tyr Asn Leu Val Leu Leu
            20                  25                  30

Asp Gln Leu Leu Leu Asn Lys Asp Met Glu Gln Val Tyr Cys Cys Asn
        35                  40                  45

Glu Leu Asn Cys Gly Phe Ser Ala Glu Gly Tyr Ala Arg Ala Arg Gly
    50                  55                  60

Ala Ala Ala Ala Ile Val Thr Phe Ser Val Gly Ala Ile Ser Ala Met
65                  70                  75                  80

Asn Ala Ile Gly Gly Ala Tyr Ala Glu Asn Leu Pro Val Ile Leu Ile
                85                  90                  95

Ser Gly Ser Pro Asn Thr Asn Asp Tyr Gly Thr Gly His Ile Leu His
            100                 105                 110

His Thr Ile Gly Thr Thr Asp Tyr Asn Tyr Gln Leu Glu Met Val Lys
        115                 120                 125
```

```
His Val Thr Cys Ala Arg Glu Ser Ile Val Ser Ala Glu Glu Ala Pro
    130                 135                 140

Ala Lys Ile Asp His Val Ile Arg Thr Ala Leu Arg Glu Arg Lys Pro
145                 150                 155                 160

Ala Tyr Leu Glu Ile Ala Cys Asn Val Ala Gly Ala Glu Cys Val Arg
                165                 170                 175

Pro Gly Pro Ile Asn Ser Leu Leu Arg Glu Leu Glu Val Asp Gln Thr
            180                 185                 190

Ser Val Thr Ala Ala Val Asp Ala Ala Val Glu Trp Leu Gln Asp Arg
        195                 200                 205

Gln Asn Val Val Met Leu Val Gly Ser Lys Leu Arg Ala Ala Ala Ala
    210                 215                 220

Glu Lys Gln Ala Val Ala Leu Ala Asp Arg Leu Gly Cys Ala Val Thr
225                 230                 235                 240

Ile Met Ala Ala Glu Lys Gly Phe Phe Pro Glu Asp His Pro Asn Phe
                245                 250                 255

Arg Gly Leu Tyr Trp Gly Glu Val Ser Ser Glu Gly Ala Gln Glu Leu
            260                 265                 270

Val Glu Asn Ala Asp Ala Ile Leu Cys Leu Ala Pro Val Phe Asn Asp
        275                 280                 285

Tyr Ala Thr Val Gly Trp Asn Ser Trp Pro Lys Gly Asp Asn Val Met
    290                 295                 300

Val Met Asp Thr Asp Arg Val Thr Phe Ala Gly Gln Ser Phe Glu Gly
305                 310                 315                 320

Leu Ser Leu Ser Thr Phe Ala Ala Ala Leu Ala Glu Lys Ala Pro Ser
                325                 330                 335

Arg Pro Ala Thr Thr Gln Gly Thr Gln Ala Pro Val Leu Gly Ile Glu
            340                 345                 350

Ala Ala Glu Pro Asn Ala Pro Leu Thr Asn Asp Glu Met Thr Arg Gln
        355                 360                 365
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Ile Gln Ser Leu Ile Thr Ser Asp Thr Thr Leu Thr Ala Glu Thr Gly
370 375 380

Asp Ser Trp Phe Asn Ala Ser Arg Met Pro Ile Pro Gly Gly Ala Arg
385 390 395 400

Val Glu Leu Glu Met Gln Trp Gly His Ile Gly Trp Ser Val Pro Ser
405 410 415

Ala Phe Gly Asn Ala Val Gly Ser Pro Glu Arg Arg His Ile Met Met
420 425 430

Val Gly Asp Gly Ser Phe Gln Leu Thr Ala Gln Glu Val Ala Gln Met
435 440 445

Ile Arg Tyr Glu Ile Pro Val Ile Ile Phe Leu Ile Asn Asn Arg Gly
450 455 460

Tyr Val Ile Glu Ile Ala Ile His Asp Gly Pro Tyr Asn Tyr Ile Lys
465 470 475 480

Asn Trp Asn Tyr Ala Gly Leu Ile Asp Val Phe Asn Asp Glu Asp Gly
485 490 495

His Gly Leu Gly Leu Lys Ala Ser Thr Gly Ala Glu Leu Glu Gly Ala
500 505 510

Ile Lys Lys Ala Leu Asp Asn Arg Arg Gly Pro Thr Leu Ile Glu Cys
515 520 525

Asn Ile Ala Gln Asp Asp Cys Thr Glu Thr Leu Ile Ala Trp Gly Lys
530 535 540

Arg Val Ala Ala Thr Asn Ser Arg Lys Pro Gln Ala
545 550 555

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Met Ala Ser Val His Gly Thr Thr Tyr Glu Leu Leu Arg Arg Gln Gly
1 5 10 15

atc gat acg gtc ttc ggc aat cct ggc tcg aac gag ctc ccg ttt ttg 96
Ile Asp Thr Val Phe Gly Asn Pro Gly Ser Asn Glu Leu Pro Phe Leu
20 25 30

aag gac ttt cca gag gac ttt cga tac atc ctg gct ttg cag gaa gcg 144
Lys Asp Phe Pro Glu Asp Phe Arg Tyr Ile Leu Ala Leu Gln Glu Ala
35 40 45

tgt gtg gtg ggc att gca gac ggc tat gcg caa gcc agt cgg aag ccg 192
Cys Val Val Gly Ile Ala Asp Gly Tyr Ala Gln Ala Ser Arg Lys Pro
50 55 60

gct ttc att aac ctg cat tct gct gct ggt acc ggc aat gct atg ggt 240
Ala Phe Ile Asn Leu His Ser Ala Ala Gly Thr Gly Asn Ala Met Gly
65 70 75 80

gca ctc agt aac gcc tgg aac tca cat tcc ccg ctg atc gtc act gcc 288
Ala Leu Ser Asn Ala Trp Asn Ser His Ser Pro Leu Ile Val Thr Ala
85 90 95

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ggc cag cag acc agg gcg atg att ggc gtt gaa gct ctg ctg acc aac      336
Gly Gln Gln Thr Arg Ala Met Ile Gly Val Glu Ala Leu Leu Thr Asn
          100                 105                 110

gtc gat gcc gcc aac ctg cca cga cca ctt gtc aaa tgg agc tac gag      384
Val Asp Ala Ala Asn Leu Pro Arg Pro Leu Val Lys Trp Ser Tyr Glu
        115                 120                 125

ccc gca agc gca gca gaa gtc cct cat gcg atg agc agg gct atc cat      432
Pro Ala Ser Ala Ala Glu Val Pro His Ala Met Ser Arg Ala Ile His
    130                 135                 140

atg gca agc atg gcg cca caa ggc cct gtc tat ctt tcg gtg cca tat      480
Met Ala Ser Met Ala Pro Gln Gly Pro Val Tyr Leu Ser Val Pro Tyr
145                 150                 155                 160

gac gat tgg gat aag gat gct gat cct cag tcc cac cac ctt ttt gat      528
Asp Asp Trp Asp Lys Asp Ala Asp Pro Gln Ser His His Leu Phe Asp
                165                 170                 175

cgc cat gtc agt tca tca gta cgc ctg aac gac cag gat ctc gat att      576
Arg His Val Ser Ser Ser Val Arg Leu Asn Asp Gln Asp Leu Asp Ile
          180                 185                 190

ctg gtg aaa gct ctc aac agc gca tcc aac ccg gcg atc gtc ctg ggc      624
Leu Val Lys Ala Leu Asn Ser Ala Ser Asn Pro Ala Ile Val Leu Gly
        195                 200                 205

ccg gac gtc gac gca gca aat gcg aac gca gac tgc gtc atg ttg gcc      672
Pro Asp Val Asp Ala Ala Asn Ala Asn Ala Asp Cys Val Met Leu Ala
    210                 215                 220

gaa cgc ctc aaa gct ccg gtt tgg gtt gcg cca tcc gct cca cgc tgc      720
Glu Arg Leu Lys Ala Pro Val Trp Val Ala Pro Ser Ala Pro Arg Cys
225                 230                 235                 240

cca ttc cct acc cgt cat cct tgc ttc cgt gga ttg atg cca gct ggc      768
Pro Phe Pro Thr Arg His Pro Cys Phe Arg Gly Leu Met Pro Ala Gly
                245                 250                 255

atc gca gcg att tct cag ctg ctc gaa ggt cac gat gtg gtt ttg gta      816
Ile Ala Ala Ile Ser Gln Leu Leu Glu Gly His Asp Val Val Leu Val
          260                 265                 270

atc ggc gct cca gtg ttc cgt tac cac caa tac gac cca ggt caa tat      864
Ile Gly Ala Pro Val Phe Arg Tyr His Gln Tyr Asp Pro Gly Gln Tyr
        275                 280                 285

ctc aaa cct ggc acg cga ttg att tcg gtg acc tgc gac ccg ctc gaa      912
Leu Lys Pro Gly Thr Arg Leu Ile Ser Val Thr Cys Asp Pro Leu Glu
    290                 295                 300

gct gca cgc gcg cca atg ggc gat gcg atc gtg gca gac att ggt gcg      960
Ala Ala Arg Ala Pro Met Gly Asp Ala Ile Val Ala Asp Ile Gly Ala
305                 310                 315                 320

atg gct agc gct ctt gcc aac ttg gtt gaa gag agc agc cgc cag ctc     1008
Met Ala Ser Ala Leu Ala Asn Leu Val Glu Glu Ser Ser Arg Gln Leu
                325                 330                 335
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cca act gca gct ccg gaa ccc gcg aag gtt gac caa gac gct ggc cga     1056
Pro Thr Ala Ala Pro Glu Pro Ala Lys Val Asp Gln Asp Ala Gly Arg
            340                 345                 350

ctt cac cca gag aca gtg ttc gac aca ctg aac gac atg gcc ccg gag     1104
Leu His Pro Glu Thr Val Phe Asp Thr Leu Asn Asp Met Ala Pro Glu
        355                 360                 365

aat gcg att tac ctg aac gag tcg act tca acg acc gcc caa atg tgg     1152
Asn Ala Ile Tyr Leu Asn Glu Ser Thr Ser Thr Thr Ala Gln Met Trp
    370                 375                 380

cag cgc ctg aac atg cgc aac cct ggt agc tac tac ttc tgt gca gct     1200
Gln Arg Leu Asn Met Arg Asn Pro Gly Ser Tyr Tyr Phe Cys Ala Ala
385                 390                 395                 400

ggc gga ctg ggc ttc gcc ctg cct gca gca att ggc gtt caa ctc gca     1248
Gly Gly Leu Gly Phe Ala Leu Pro Ala Ala Ile Gly Val Gln Leu Ala
                405                 410                 415

gaa ccc gag cga caa gtc atc gcc gtc att ggc gac gga tcg gcg aac     1296
Glu Pro Glu Arg Gln Val Ile Ala Val Ile Gly Asp Gly Ser Ala Asn
            420                 425                 430

tac agc att agt gcg ttg tgg act gca gct cag tac aac atc ccc act     1344
Tyr Ser Ile Ser Ala Leu Trp Thr Ala Ala Gln Tyr Asn Ile Pro Thr
        435                 440                 445

atc ttc gtg atc atg aac aac ggc acc tac ggt gcg ttg cga tgg ttt     1392
Ile Phe Val Ile Met Asn Asn Gly Thr Tyr Gly Ala Leu Arg Trp Phe
    450                 455                 460

gcc ggc gtt ctc gaa gca gaa aac gtt cct ggg ctg gat gtg cca ggg     1440
Ala Gly Val Leu Glu Ala Glu Asn Val Pro Gly Leu Asp Val Pro Gly
465                 470                 475                 480

atc gac ttc cgc gca ctc gcc aag ggc tat ggt gtc caa gcg ctg aaa     1488
Ile Asp Phe Arg Ala Leu Ala Lys Gly Tyr Gly Val Gln Ala Leu Lys
                485                 490                 495

gcc gac aac ctt gag cag ctc aag ggt tcg cta caa gaa gcg ctt tct     1536
Ala Asp Asn Leu Glu Gln Leu Lys Gly Ser Leu Gln Glu Ala Leu Ser
            500                 505                 510

gcc aaa ggc ccg gta ctt atc gaa gta agc acc gta agc ccg gtg aag     1584
Ala Lys Gly Pro Val Leu Ile Glu Val Ser Thr Val Ser Pro Val Lys
        515                 520                 525

tga                                                                1587
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Ile Asp Thr Val Phe Gly Asn Pro Gly Ser Asn Glu Leu Pro Phe Leu
            20                  25                  30

Lys Asp Phe Pro Glu Asp Phe Arg Tyr Ile Leu Ala Leu Gln Glu Ala
        35                  40                  45

Cys Val Val Gly Ile Ala Asp Gly Tyr Ala Gln Ala Ser Arg Lys Pro
    50                  55                  60

Ala Phe Ile Asn Leu His Ser Ala Ala Gly Thr Gly Asn Ala Met Gly
65                  70                  75                  80

Ala Leu Ser Asn Ala Trp Asn Ser His Ser Pro Leu Ile Val Thr Ala
                85                  90                  95

Gly Gln Gln Thr Arg Ala Met Ile Gly Val Glu Ala Leu Leu Thr Asn
            100                 105                 110

Val Asp Ala Ala Asn Leu Pro Arg Pro Leu Val Lys Trp Ser Tyr Glu
        115                 120                 125

Pro Ala Ser Ala Ala Glu Val Pro His Ala Met Ser Arg Ala Ile His
    130                 135                 140

Met Ala Ser Met Ala Pro Gln Gly Pro Val Tyr Leu Ser Val Pro Tyr
145                 150                 155                 160

Asp Asp Trp Asp Lys Asp Ala Asp Pro Gln Ser His His Leu Phe Asp
                165                 170                 175

Arg His Val Ser Ser Ser Val Arg Leu Asn Asp Gln Asp Leu Asp Ile
            180                 185                 190

Leu Val Lys Ala Leu Asn Ser Ala Ser Asn Pro Ala Ile Val Leu Gly
        195                 200                 205

Pro Asp Val Asp Ala Ala Asn Ala Asn Ala Asp Cys Val Met Leu Ala
    210                 215                 220
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```
Glu Arg Leu Lys Ala Pro Val Trp Val Ala Pro Ser Ala Pro Arg Cys
225                 230                 235                 240

Pro Phe Pro Thr Arg His Pro Cys Phe Arg Gly Leu Met Pro Ala Gly
                245                 250                 255

Ile Ala Ala Ile Ser Gln Leu Leu Glu Gly His Asp Val Val Leu Val
            260                 265                 270

Ile Gly Ala Pro Val Phe Arg Tyr His Gln Tyr Asp Pro Gly Gln Tyr
        275                 280                 285

Leu Lys Pro Gly Thr Arg Leu Ile Ser Val Thr Cys Asp Pro Leu Glu
    290                 295                 300

Ala Ala Arg Ala Pro Met Gly Asp Ala Ile Val Ala Asp Ile Gly Ala
305                 310                 315                 320

Met Ala Ser Ala Leu Ala Asn Leu Val Glu Glu Ser Ser Arg Gln Leu
                325                 330                 335

Pro Thr Ala Ala Pro Glu Pro Ala Lys Val Asp Gln Asp Ala Gly Arg
            340                 345                 350

Leu His Pro Glu Thr Val Phe Asp Thr Leu Asn Asp Met Ala Pro Glu
        355                 360                 365

Asn Ala Ile Tyr Leu Asn Glu Ser Thr Ser Thr Thr Ala Gln Met Trp
    370                 375                 380

Gln Arg Leu Asn Met Arg Asn Pro Gly Ser Tyr Tyr Phe Cys Ala Ala
385                 390                 395                 400

Gly Gly Leu Gly Phe Ala Leu Pro Ala Ala Ile Gly Val Gln Leu Ala
                405                 410                 415

Glu Pro Glu Arg Gln Val Ile Ala Val Ile Gly Asp Gly Ser Ala Asn
            420                 425                 430

Tyr Ser Ile Ser Ala Leu Trp Thr Ala Ala Gln Tyr Asn Ile Pro Thr
        435                 440                 445

Ile Phe Val Ile Met Asn Asn Gly Thr Tyr Gly Ala Leu Arg Trp Phe
    450                 455                 460
```

```
Ala Gly Val Leu Glu Ala Glu Asn Val Pro Gly Leu Asp Val Pro Gly
465                 470                 475                 480

Ile Asp Phe Arg Ala Leu Ala Lys Gly Tyr Gly Val Gln Ala Leu Lys
                485                 490                 495

Ala Asp Asn Leu Glu Gln Leu Lys Gly Ser Leu Gln Glu Ala Leu Ser
            500                 505                 510

Ala Lys Gly Pro Val Leu Ile Glu Val Ser Thr Val Ser Pro Val Lys
        515                 520                 525
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